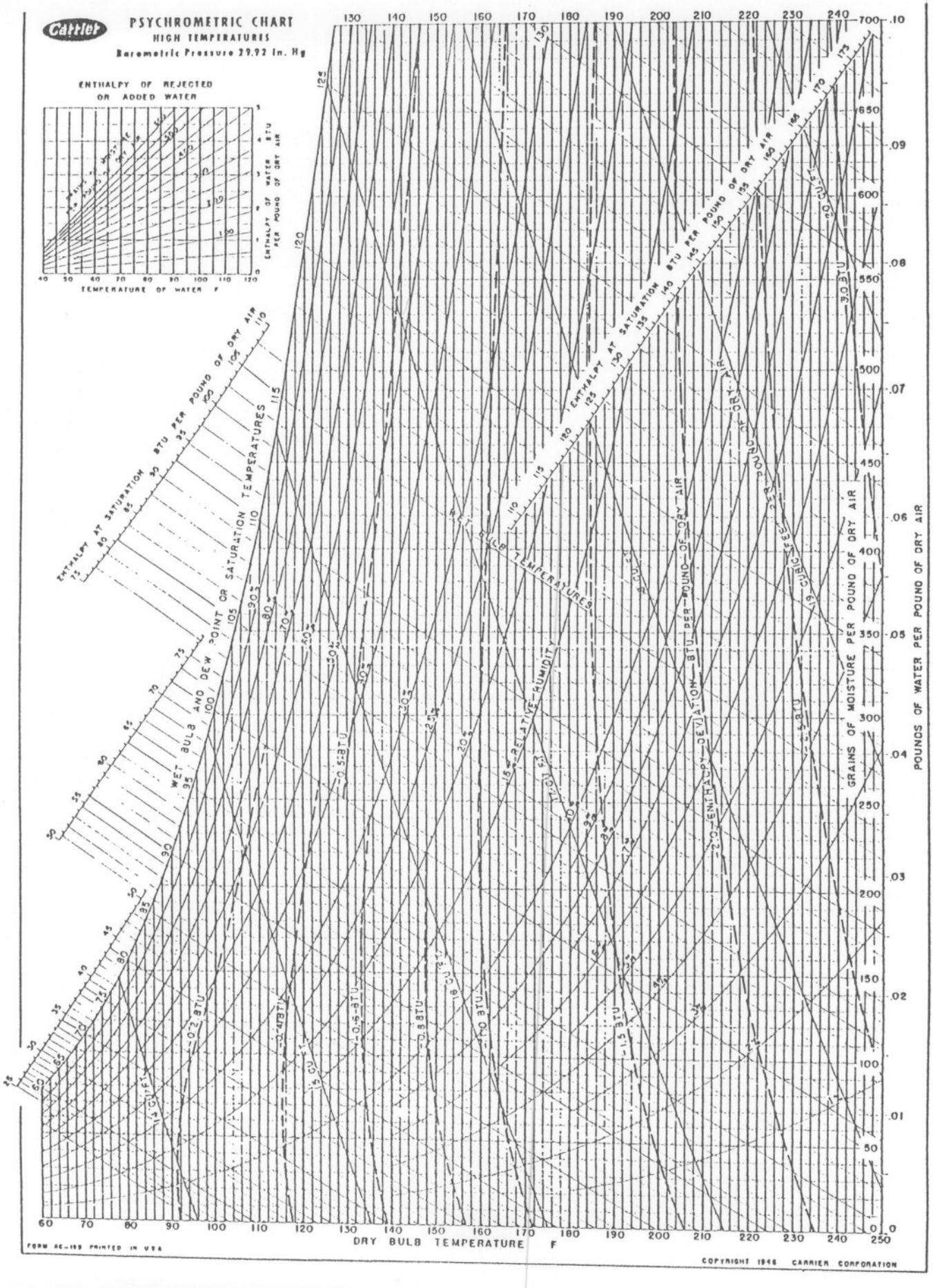
# Supplemental Materials

## Course 345


Carrier
PSYCHROMETRIC CHART
HIGH TEMPERATURES
Barometric Pressure 29.92 In. Hg
ENTHALPY OF REJECTED OR ADDED WATER
TEMPERATURE OF WATER F
ENTHALPY OF WATER PER POUND OF DRY AIR
ENTHALPY AT SATURATION BTU PER POUND OF DRY AIR
WET BULB AND DEW POINT OR SATURATION TEMPERATURES
WET BULB TEMPERATURES
RELATIVE HUMIDITY
ENTHALPY DEVIATION BTU PER POUND OF DRY AIR
CUBIC FEET PER POUND OF DRY AIR
GRAINS OF MOISTURE PER POUND OF DRY AIR
POUNDS OF WATER PER POUND OF DRY AIR
DRY BULB TEMPERATURE F
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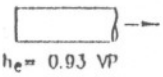
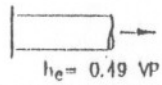
# Figure 2-11: Hood Entry Loss Factors (ACGIH, 1988)



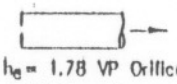
$h_e$ = 0.93 VP

PLAIN DUCT END



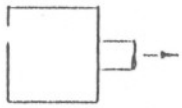
$h_e$ = 0.49 VP

FLANGED DUCT END



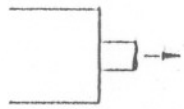
$h_e$ = 1.78 VP Orifice

SHARP-EDGED ORIFICE



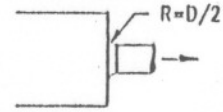
$h_e$ = 2.3 VP Duct, (when duct velocity = slot velocity)
Better: 1.78 VP Orifice + 0.49 VP Duct

ORIFICE PLUS FLANGED DUCT
(Many slot types)



$h_e$ = 0.50 VP

DIRECT BRANCH-BOOTH

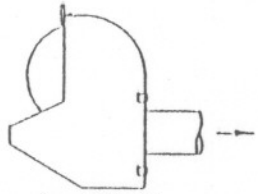



$h_e$ = 0.06 VP to 0.10 VP

BOOTH PLUS ROUNDED ENTRANCE

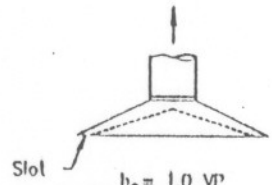
$h_e$ = 1.5 VP

TRAP OR SETTLING CHAMBER



$h_e$ = 0.65 VP

STANDARD GRINDER HOOD




$h_e$ = 1.0 VP

DOUBLE (Inner cone) HOOD

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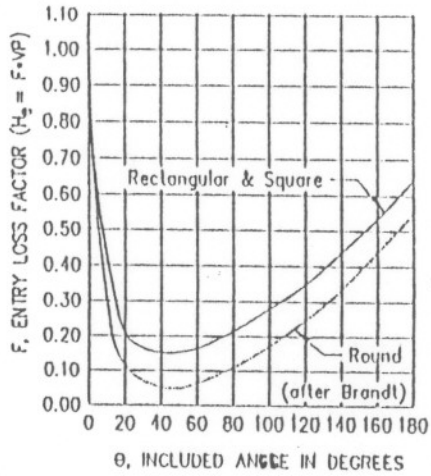
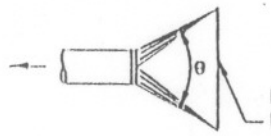
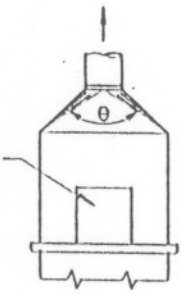


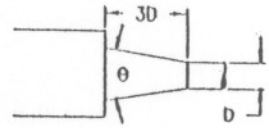

Face area at least 2 times duct area




TAPERED HOODS

Flanged or unflanged; round, square or rectangular. θ is the major angle on rectangular hoods.

| θ | ENTRY LOSS ROUND | ENTRY LOSS RECTANGULAR |
|---|---|---|
| 15° | 0.15 VP | 0.25 VP |
| 30° | 0.08 VP | 0.16 VP |
| 45° | 0.06 VP | 0.15 VP |
| 60° | 0.08 VP | 0.17 VP |
| 90° | 0.15 VP | 0.25 VP |
| 120° | 0.26 VP | 0.35 VP |
| 150° | 0.40 VP | 0.48 VP |




MISCELLANEOUS VALUES

| HOOD | ENTRY LOSS, F |
|---|---|
| Abrasive blast chamber | 1.0 |
| Abrasive blast elevator | 2.3 |
| Abrasive separator | 2.3 |
| Elevators (enclosures) | 0.69 |
| Flanged pipe plus close elbow | 0.8 |
| Plain pipe plus close elbow | 1.60 |

VP = Velocity Pressure in Duct
SP = Static Pressure at Throat, "wg
$h_e$ = Entry Loss, "wg
Q = Volumetric Flowrate, cfm
A = Cross Section at Throat, $ft^2$

Figure 3-1a: Straight Duct Frictional Losses (ACGIH, 1988)

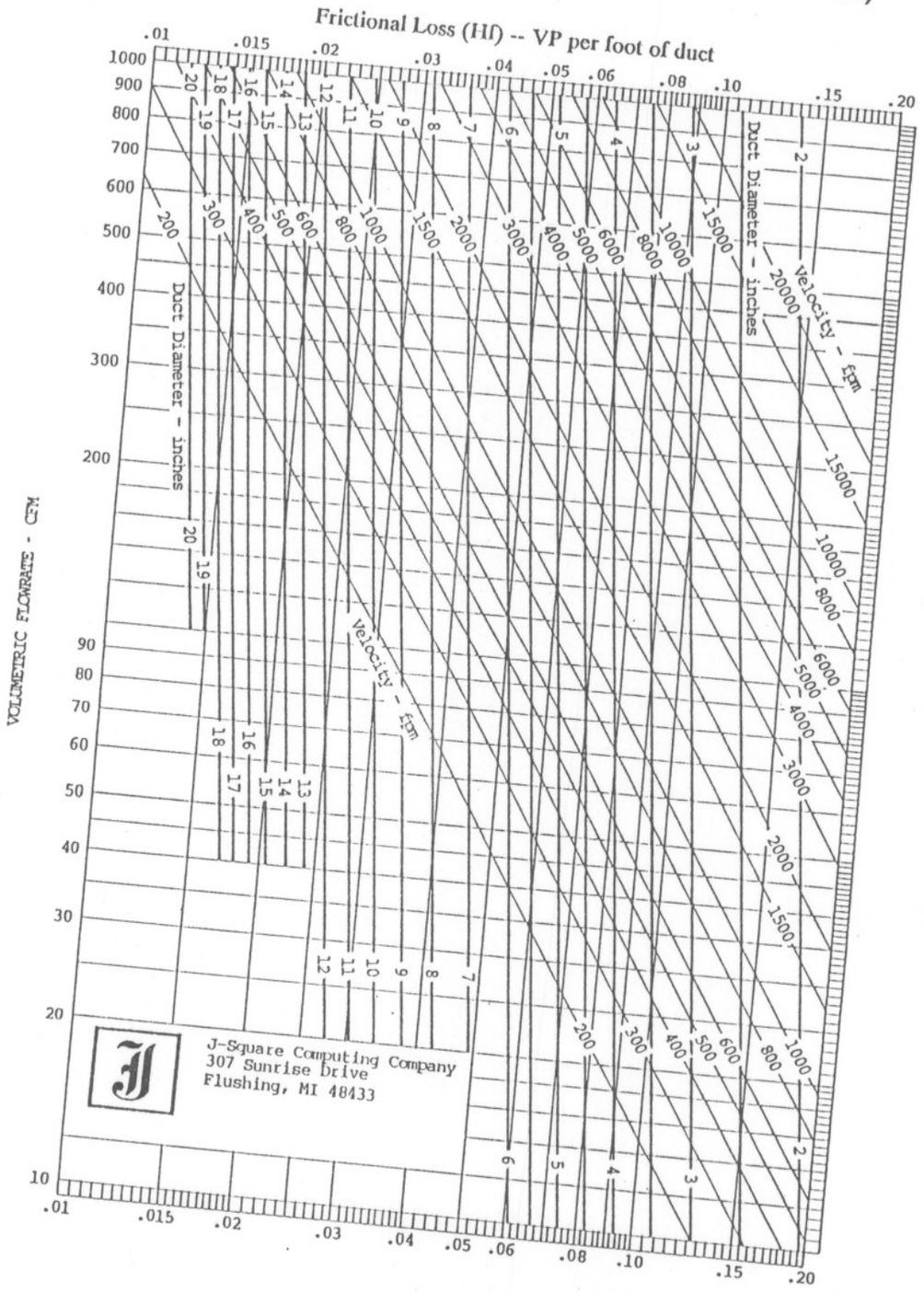


Figure 3-1b: Straight Duct Frictional Losses (ACGIH, 1988)

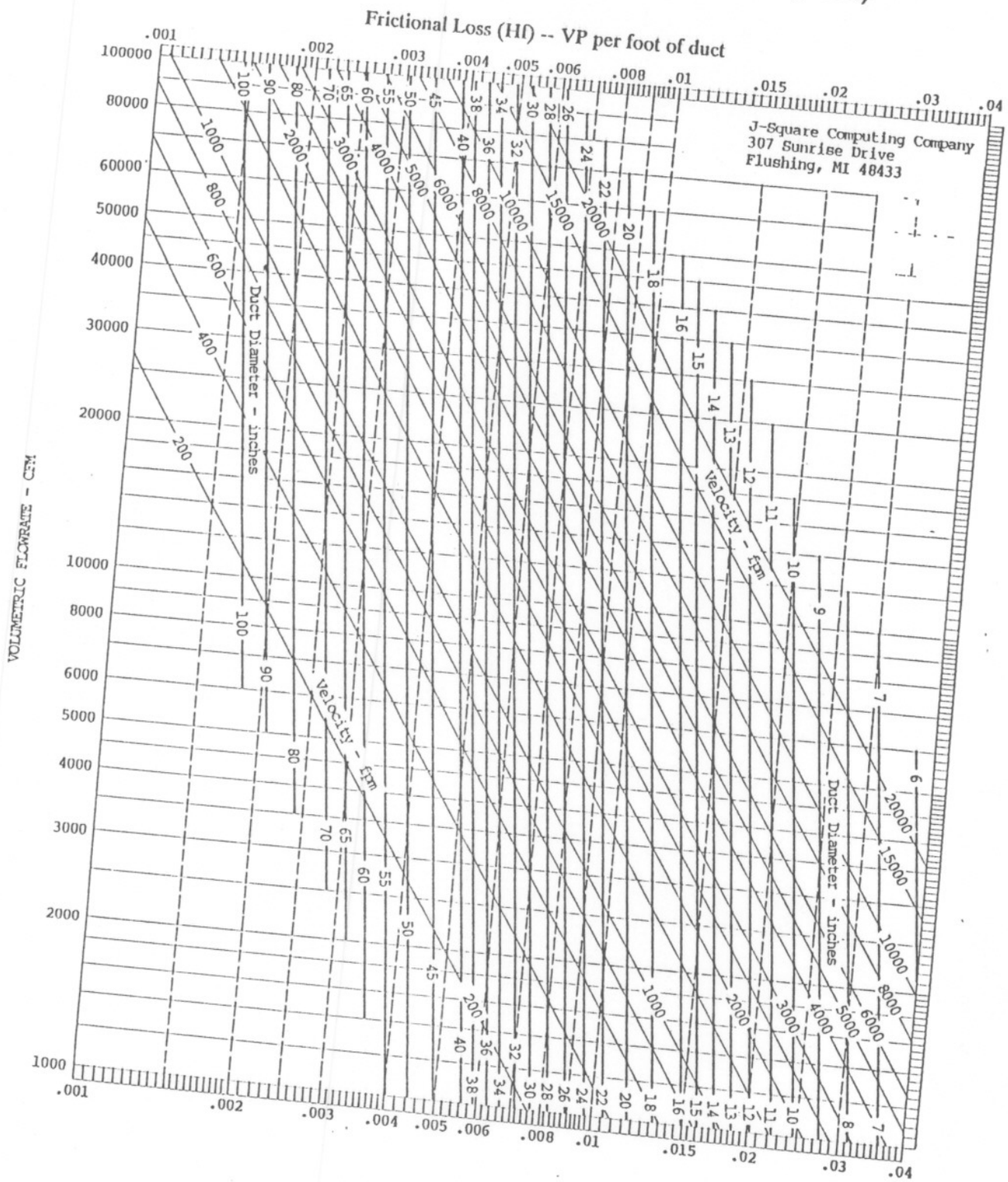
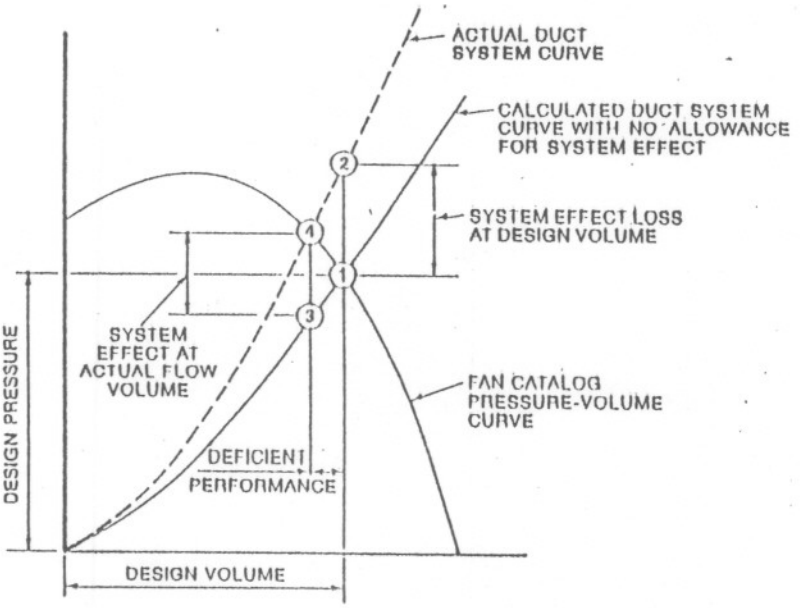
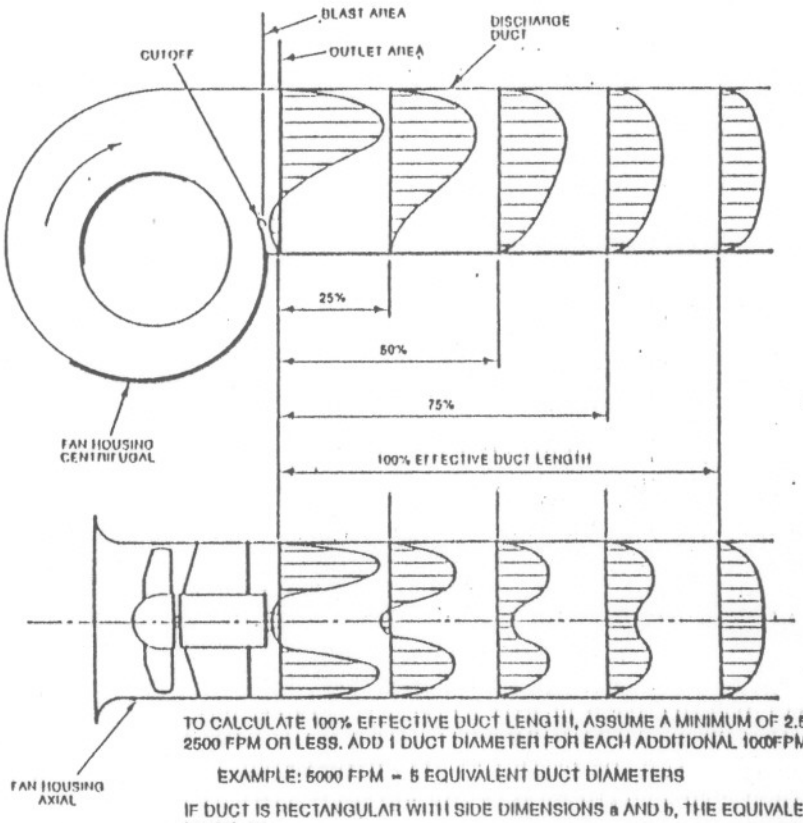


Figure 5-14: Influence of System Effects (AMCA, 1979)



# Figure 5-15: System Effect Factors for Outlet Ducts (ACGIH, 1988)




TO CALCULATE 100% EFFECTIVE DUCT LENGTH, ASSUME A MINIMUM OF 2.5 DUCT DIAMETERS FOR 2500 FPM OR LESS. ADD 1 DUCT DIAMETER FOR EACH ADDITIONAL 1000FPM.

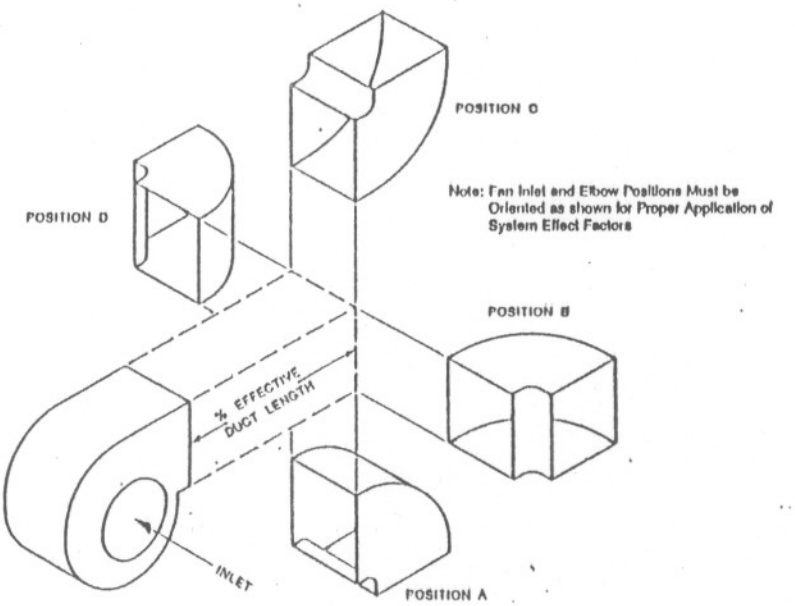
EXAMPLE: 5000 FPM = 5 EQUIVALENT DUCT DIAMETERS

IF DUCT IS RECTANGULAR WITH SIDE DIMENSIONS a AND b, THE EQUIVALENT DUCT DIAMETER IS EQUAL TO

$$\sqrt{\frac{4ab}{\pi}}$$

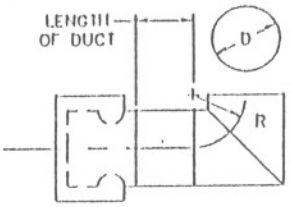
| | No Duct | 12% Effective Duct | 25% Effective Duct | 50% Effective Duct | 100% Effective Duct |
|---|---|---|---|---|---|
| Pressure Recovery | 0% | 50% | 80% | 90% | 100% |
| Blast Area / Outlet Area | SYSTEM EFFECT FACTORS | | | | |
| 0.4 | 2.0 | 1.0 | 0.40 | 0.18 | — |
| 0.5 | 2.0 | 1.0 | 0.40 | 0.18 | — |
| 0.6 | 1.0 | 0.66 | 0.33 | 0.14 | — |
| 0.7 | 0.6 | 0.40 | 0.14 | — | — |
| 0.8 | 0.47 | 0.22 | 0.10 | — | — |
| 0.9 | 0.22 | 0.14 | — | — | — |
| 1.0 | — | — | — | — | — |

# Figure 5-16: System Effect Factors for Outlet Elbows (ACGIH, 1988)




| Blast Area / Outlet Area | Outlet Elbow Position | No Outlet Duct | 12% Effective Duct | 25% Effective Duct | 50% Effective Duct | 100% Effective Duct |
|---|---|---|---|---|---|---|
| 0.4 | A | 3.2 | 2.5 | 1.8 | 0.8 | NO SYSTEM EFFECT FACTOR |
| | B | 4.6 | 3.9 | 2.5 | 1.2 | |
| | C | 5.5 | 4.6 | 3.2 | 1.6 | |
| | D | 5.5 | 4.6 | 3.2 | 1.6 | |
| 0.5 | A | 2.0 | 1.6 | 1.2 | 0.53 | |
| | B | 2.9 | 2.3 | 1.8 | 0.80 | |
| | C | 3.9 | 2.9 | 2.3 | 1.0 | |
| | D | 3.9 | 2.9 | 2.3 | 1.0 | |
| 0.6 | A | 1.6 | 1.4 | 1.0 | 0.40 | |
| | B | 2.0 | 1.6 | 1.2 | 0.53 | |
| | C | 2.9 | 2.3 | 1.8 | 0.80 | |
| | D | 2.5 | 2.0 | 1.4 | 0.66 | |
| 0.7 | A | 0.66 | 0.53 | 0.40 | 0.18 | |
| | B | 1.0 | 0.80 | 0.53 | 0.26 | |
| | C | 1.4 | 1.2 | 0.80 | 0.33 | |
| | D | 1.2 | 1.0 | 0.66 | 0.33 | |
| 0.8 | A | 0.8 | 0.66 | 0.47 | 0.22 | |
| | B | 1.2 | 1.0 | 0.66 | 0.33 | |
| | C | 1.6 | 1.4 | 1.0 | 0.40 | |
| | D | 1.4 | 1.2 | 0.8 | 0.33 | |
| 0.9 | A | 0.66 | 0.53 | 0.40 | 0.18 | |
| | B | 1.0 | 0.80 | 0.53 | 0.26 | |
| | C | 1.2 | 1.0 | 0.66 | 0.33 | |
| | D | 1.0 | 0.80 | 0.53 | 0.26 | |
| 1.0 | A | 1.0 | 0.80 | 0.53 | 0.26 | |
| | B | 0.66 | 0.53 | 0.40 | 0.18 | |
| | C | 1.0 | 0.80 | 0.53 | 0.26 | |
| | D | 1.0 | 0.80 | 0.53 | 0.26 | |

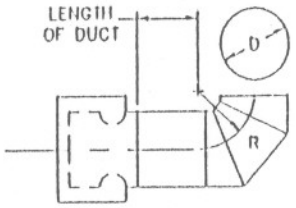
# Figure 5-17: System Effect Factors for Inlet Elbows (ACGIH, 1988)




SYSTEM EFFECT FACTORS

| R/D | NO DUCT | 2D DUCT | 5D DUCT |
|---|---|---|---|
| – | 3.2 | 2.0 | 1.0 |

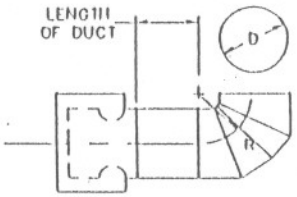
A. TWO-PIECE MITERED 90° ROUND SECTION ELBOW -- NOT VANED.




SYSTEM EFFECT FACTORS

| R/D | NO DUCT | 2D DUCT | 5D DUCT |
|---|---|---|---|
| 0.5 | 2.5 | 1.6 | 0.8 |
| 0.75 | 1.6 | 1.0 | 0.47 |
| 1.0 | 1.2 | 0.66 | 0.33 |
| 2.0 | 1.0 | 0.53 | 0.33 |
| 3.0 | 0.8 | 0.47 | 0.26 |

B. THREE-PIECE MITERED 90° ROUND SECTION ELBOW -- NOT VANED.




SYSTEM EFFECT FACTORS

| R/D | NO DUCT | 2D DUCT | 5D DUCT |
|---|---|---|---|
| 0.5 | 1.8 | 1.0 | 0.53 |
| 0.75 | 1.4 | 0.8 | 0.40 |
| 1.0 | 1.2 | 0.66 | 0.33 |
| 2.0 | 1.0 | 0.53 | 0.33 |
| 3.0 | 0.66 | 0.40 | 0.22 |

C. FOUR OR MORE PIECE MITERED 90° ROUND SECTION ELBOW -- NOT VANED.